One Analyzer, One Motor and a Prayer

Donovan Rafferty
Washington State Department of Ecology

This survey involved one person with one instrument attempting to get "snapshots in time" of ground level ozone concentrations

Summer 2007 Campaign

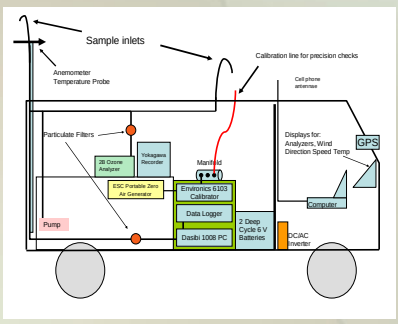
Decision makers at the Washington State Department of Ecology directed staff to explore inexpensive ways to monitor for ground level ozone to determine if the established ozone monitoring network was effectively capturing ozone events.

One Analyzer (2B Technologies 202)

Two different lightweight ozone analyzers were evaluated for portability, ruggedness, accuracy, power requirements and data logging capabilities. The 2B Technologies Model 202 ozone analyzer was selected for duty.

One Motor (The Monitoring Van)

The 2B analyzer was placed in a van with additional support equipment for "back-up" (though never needed). Two intake probes were installed, one used while moving, the other (telescoping) for stationary monitoring and weather observations.



The Prayer (Quality Assurance Project Plan)

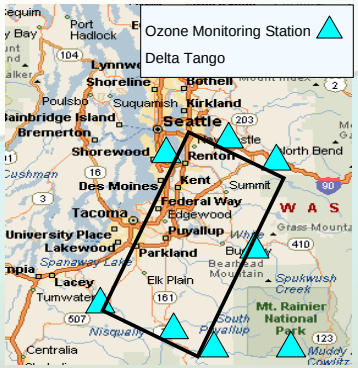
Though only a small project, a Quality Assurance Project Plan (QAPP) was written before the survey began and proved invaluable for planning purposes. The QAPP outlined the Data Quality Objectives and the Sample Process Design of the Project. Data Quality Indicators were selected and measured to determine the accuracy of the data.

Selecting Designated Targets (Delta Tango)

The spatial boundaries of the survey was determined by the current ozone monitoring network creating a perimeter southeast of Seattle and Tacoma.

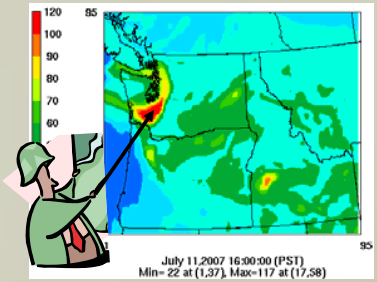
Several predetermined locations were selected as Designated Targets (Delta Tango) within the perimeter equidistant from current monitoring stations.

Only after reviewing ozone forecasts for a predicted high ozone day would the van be dispatched to one of the targets nearest the predicted ozone event.



Ozone Forecast Critical for Planning Attack

The Air Indicator Report for Public Awareness and Community Tracking (AIRPACT) with NOAA's National Weather Service Experimental Ozone Air Quality Forecast Guidance provided 72 hours advance notice of an ozone event. Once updated forecast surveillance confirmed that an event was imminent and concentrations above 75 ppb were predicted, the decision to attack was made.



"This is the target for today. Good hunting!"

AIRNow-Tech Navigator Guides Van to Point of No Return (Lima Delta)

Once at Delta Tango, ozone concentrations captured by the "mobile" analyzer was compared against hourly ozone data from AIRNow-Tech Navigator.

During each mission, Navigator relayed critical information of movement on the ground with near-real-time ozone concentrations and wind trajectories. The graphics created a visual "picture" of the ozone plume thus providing invaluable information needed to assists in directing the van to Delta Tango, and eventually to Lima Delta.

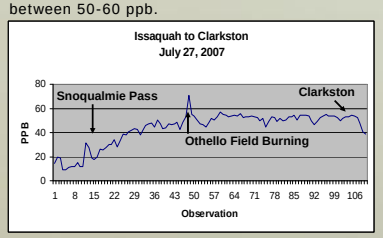
Mission Reports

After each mission, the accuracy of the model forecast was compared with ozone data captured by the van and other sites in the area. On several occasions, the models proved to be very accurate. On July 11, the highest ozone event for 2007, AIRPACT and NOAA forecast agreed (AIRPACT predicted a high of 117 ppb). An hourly ozone concentration of 114 ppb was captured near Enumclaw during which time the van probed for additional data upwind, downwind and between sites located within this area of highest impact.

Reconnaissance

Cool weather in western Washington resulted in few days when ozone levels climbed above 75 ppb. Therefore, sampling outside the perimeter was conducted in areas where little monitoring has been done.

Several reconnaissance missions were made across Washington State providing ozone profiles that included Yakima, Clarkston and the Tri-Cities. Model predictions for these areas proved to be very accurate with maximum hourly values between 50-60 ppb.

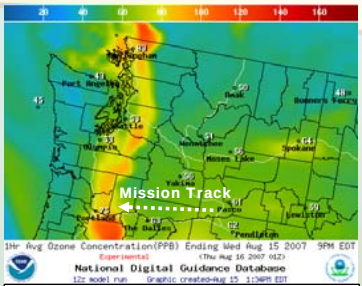


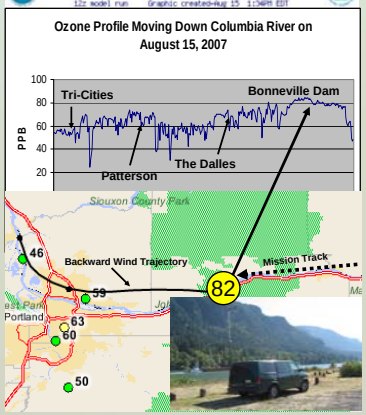
Analyzer Proves Reliable in Hostile Conditions

With constant vibrations and temperatures often exceeding 100 degrees, the analyzer proved reliable throughout the campaign. No malfunctions were experienced nor adjustments to the instrument needed.

The analyzer demonstrated its versatility when it was removed from the van, placed in a small container and used to measure ozone concentrations near the Tri-Cities. From the van to the rooftop in just minutes and the analyzer continued to store data.

Models predicted an ozone plume to move up the Columbia River Gorge the following week, thus the analyzer was retrieved and placed back into the van. With a compass setting for due west, the van headed down river to intercept the plume somewhere in the Gorge.





At 1700 hour, ozone concentrations rose noticeably east of Bonneville Dam. The forecast was correct, the target was hit.

Note: On August 15, the NOAA/EPA model forecast predicted a high of 78 ppb for Portland. The actual highest hourly ozone concentration recorded in Portland on this day was 77 ppb.

Excellent Precision, Comparability and Accuracy

Routinely, the precision of the analyzer was compared against an board ozone standard referenced to a NIST photometer. Results were excellent with bias less than 2%

During the survey, before each mission, a comparison was performed against another analyzer operating in the network nearby. On average, the comparisons differed by only one ppb.

An independent EPA assessment was performed to determine the accuracy of the sample collection system in the monitoring van. A through-the-probe audit resulted in a difference of less than 1%.

18 Counties Struck in 23 Days

The model forecasts, mobility of the vehicle, versatility of the analyzer and ground support from Navigator all led to a successful campaign. When used together, these tools provide the flexibility to monitor only on days and in locations where the highest concentrations of ozone are occurring.

The summer 2007 campaign:

1. Confirmed that the highest ozone concentrations are occurring along the perimeter of the ozone monitoring network between Enumclaw (Mud Mountain Dam) and Eatonville (Pack Forest)
2. Demonstrated that Pack Forest remains a good representative site that captures high ozone events
3. Demonstrated model forecasts for regions of eastern Washington appear accurate
4. Intercepted and recorded ozone plumes moving up the Columbia River Gorge
5. Demonstrated additional tools decision makers can use to assess their ozone monitoring network.

With the right tools, it is possible to "hit the target" with only one analyzer, one motor and a prayer.

What a show, what a fight
We really hit our target for tonight
With just one motor……
We can still carry on
Coming' in on a wing and a prayer

Adaptation of WWII song "Coming In on a Wing and a Prayer"

"Mission Accomplished"